CARBURETTED
WATER GAS SETS

BULLETIN 210-C

The Western Gas Construction Co.
FORT WAYNE, INDIANA
Engineers and Builders

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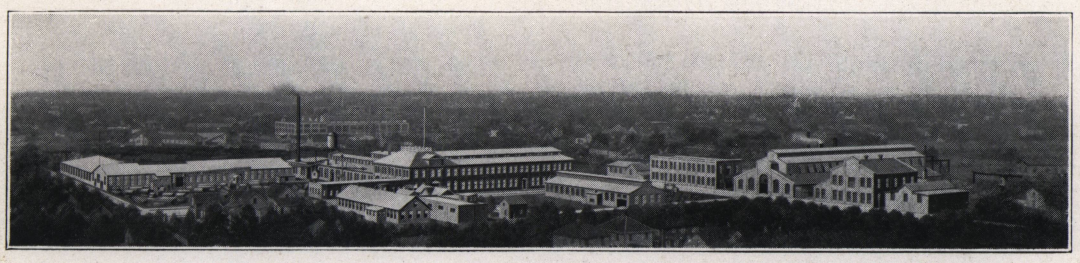


The standard "WESTERN" Carburetted Water Gas Sets ranging in size from 11'0" to 6'6" inclusive are provided with reversed steam connections which include our model "H" Hot Valve.

It is optional on the 5'6" Set as to the furnishing of the Reversing Connections.

The standard sets smaller than the 5'6" are not equipped with the Reversing Connections as the extra cost involved in furnishing the necessary equipment to accomplish this, does not warrant the extra expenditure when compared to the results obtained by its use on these small sets.

The capacity of Carburetted Water Gas Sets is dependent upon several factors such as quality of fuel used, the speed with which the various mechanical parts are operated, etc. The following table gives a conservative rating for the various sizes of standard "WESTERN" machines.

Size of Set	Capacity per Day in Cubic Feet
4'0"	200,000— 220,000
4'6"	297,000— 326,000
5'0"	415,000— 456,000
5'6"	552,000— 607,000
6'6"	886,000— 974,000
7'6"	1,296,000—1,425,000
8'6"	1,660,000—1,826,000
9'6"	2,210,000—2,431,000
10'6"	2,840,000—3,124,000
11'0"	3,180,000—3,500,000

The "WESTERN" Carburetted Water Gas Sets have embodied in them many engineering features, which, combined with the excellency of workmanship entering into their construction, creates a machine capable of producing a maximum amount of gas with a minimum amount of expenditure in their operation and maintenance.

The following are some of the principal features by which a "WESTERN" Water Gas Set can readily be distinguished:

REVERSING VALVE (See Bulletin number 210-D) this is the Hot Valve that stays cool. It is substantially built to withstand the severe operating conditions which are expected of this part of the machine. Owing to its unique design it is situated entirely under the operating floor, allowing greater freedom of action for the operator in handling the machine and consequently with improved results in operation.

HYDRAULIC EQUIPMENT for the larger sizes of machines is provided, enabling the operator to run the machine from a Central Control Station where are located the instrument board, with the meters and gauges and the Hydraulic Control Valve Stand.

HYDRAULIC CONTROL VALVE for controlling the operation of the hydraulic cylinders is of neat appearance, substantial construction and so designed that the

various operations can take place only in their proper sequence, thereby eliminating the possibility of any mistake in the operation of the machine.

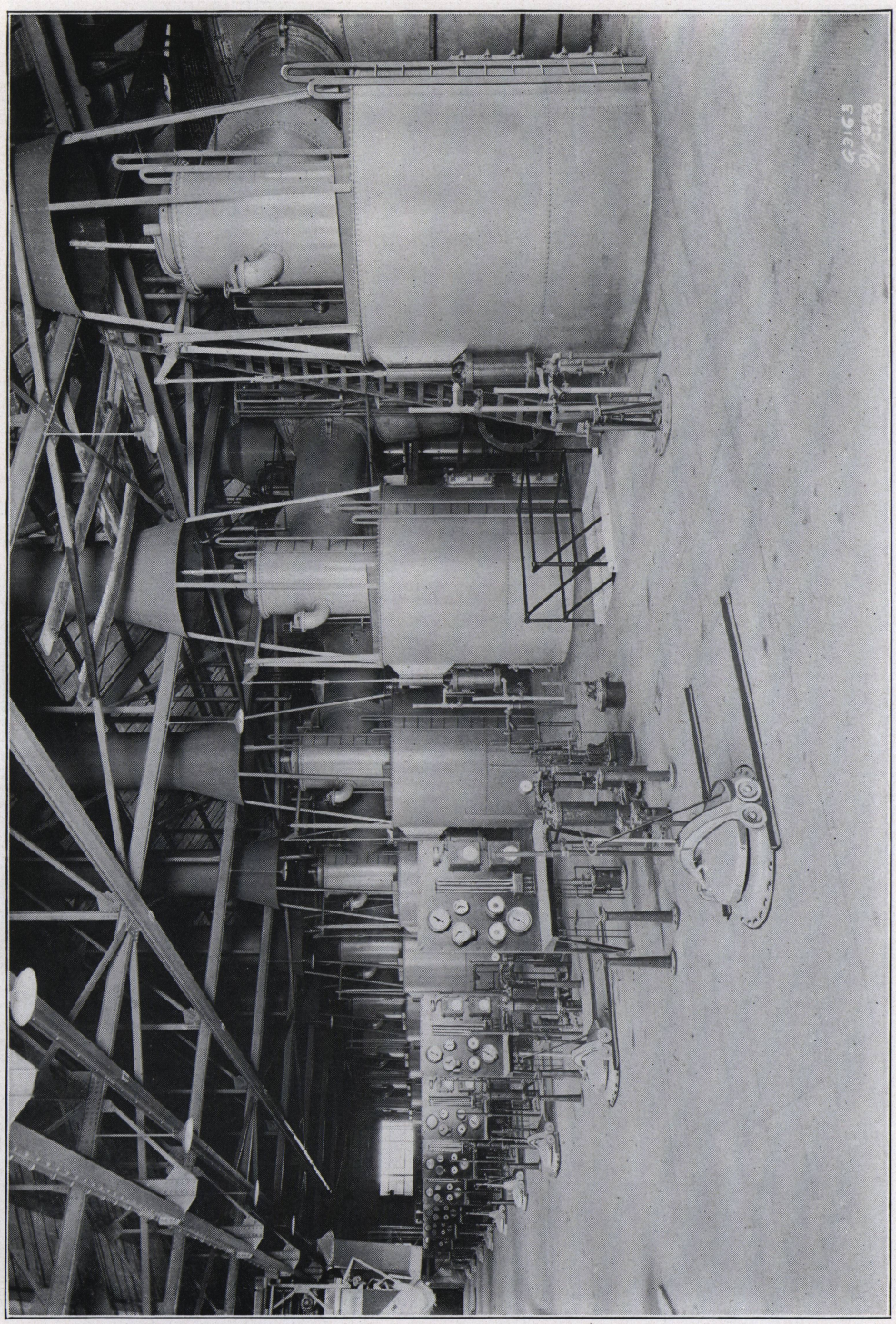
IMPROVED CENTER OIL SPRAY — by which the oil is introduced into the carburetter in the form of a fine mist thereby completely vaporizing it. The oil spray being operated in connection with the stack valve so that during the blasting period the spray is always raised out of the fire zone, eliminating the possibility of its being burned by the hot gases passing thru the carburetter during this period. The design is such that the spray can readily be removed for inspection or cleaning, and provision is made for purging out the spray at the end of each run by introducing live steam for a short period after the oil has been shut off.

CLINKER DOORS — of ample proportion permitting free access to all parts of the grate and of heavy construction to withstand the severe wear which invariably happens to this part of the machine.

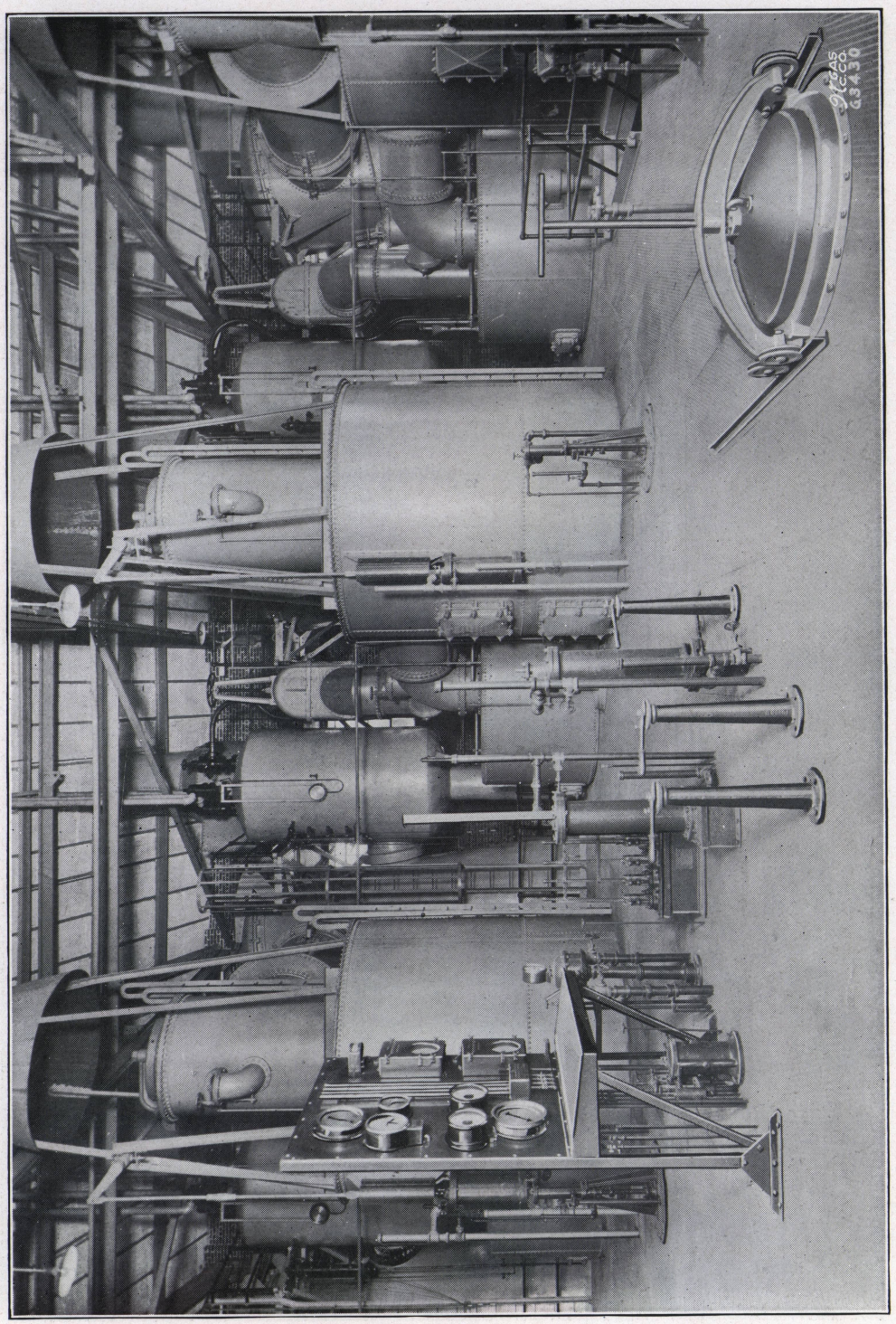
WESTERN VALVES — of the double wedge revolving disc type so well known to the gas fraternity, are absolutely tight, an essential function of this part of the machine.

ARCHED DOMES — in the "WESTERN" Water Gas Sets combined with the strong design of tile around the offtake nozzles, form an extremely strong construction well able to withstand the results of varying temperatures.

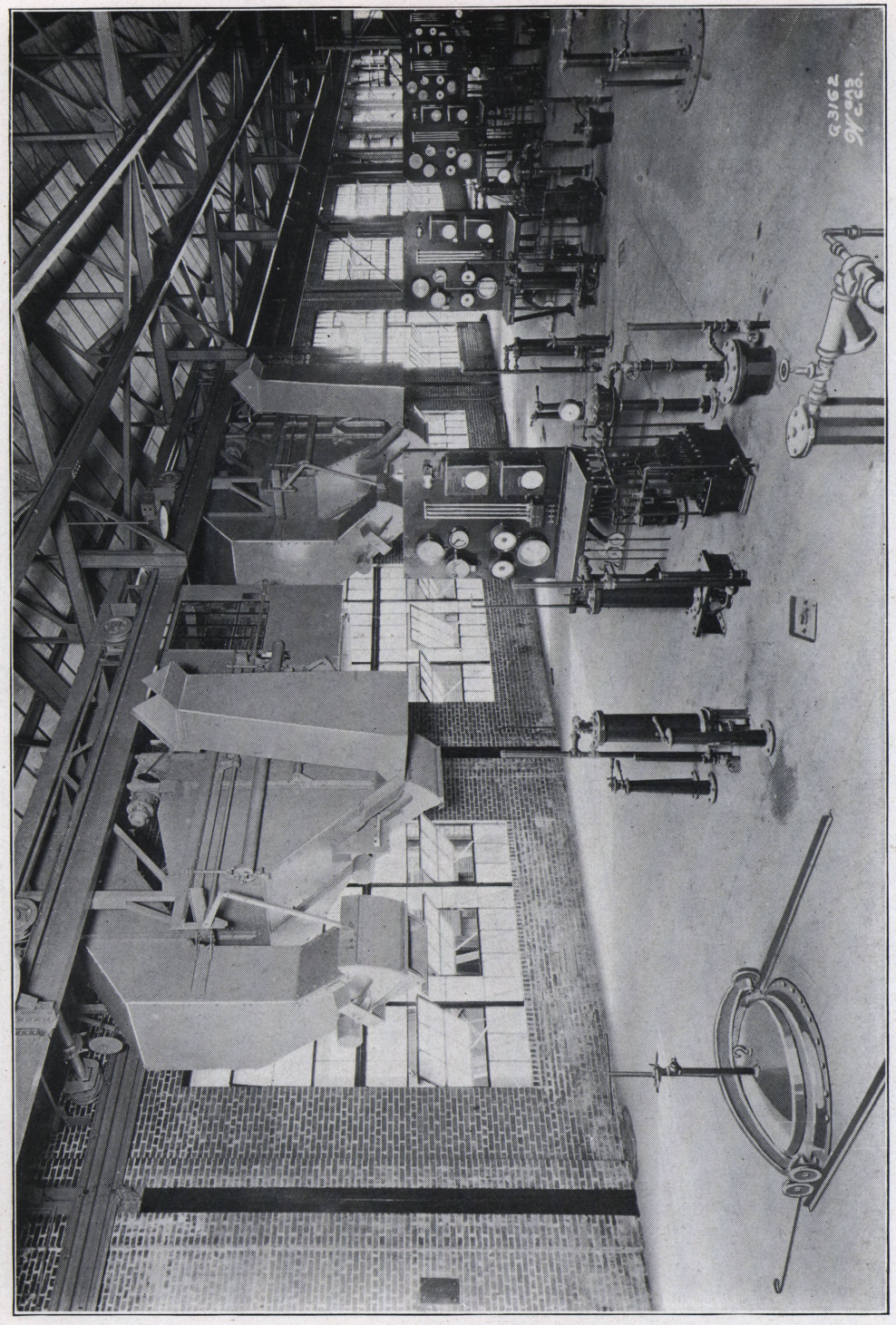
The illustrations on the following pages show a few typical carburetted water gas sets installed by the Western Gas Construction Company and our well equipped plant where they were fabricated. Being builders as well as designers, our customers are assured that all materials and workmanship entering into the construction of our apparatus is of the very best quality throughout.



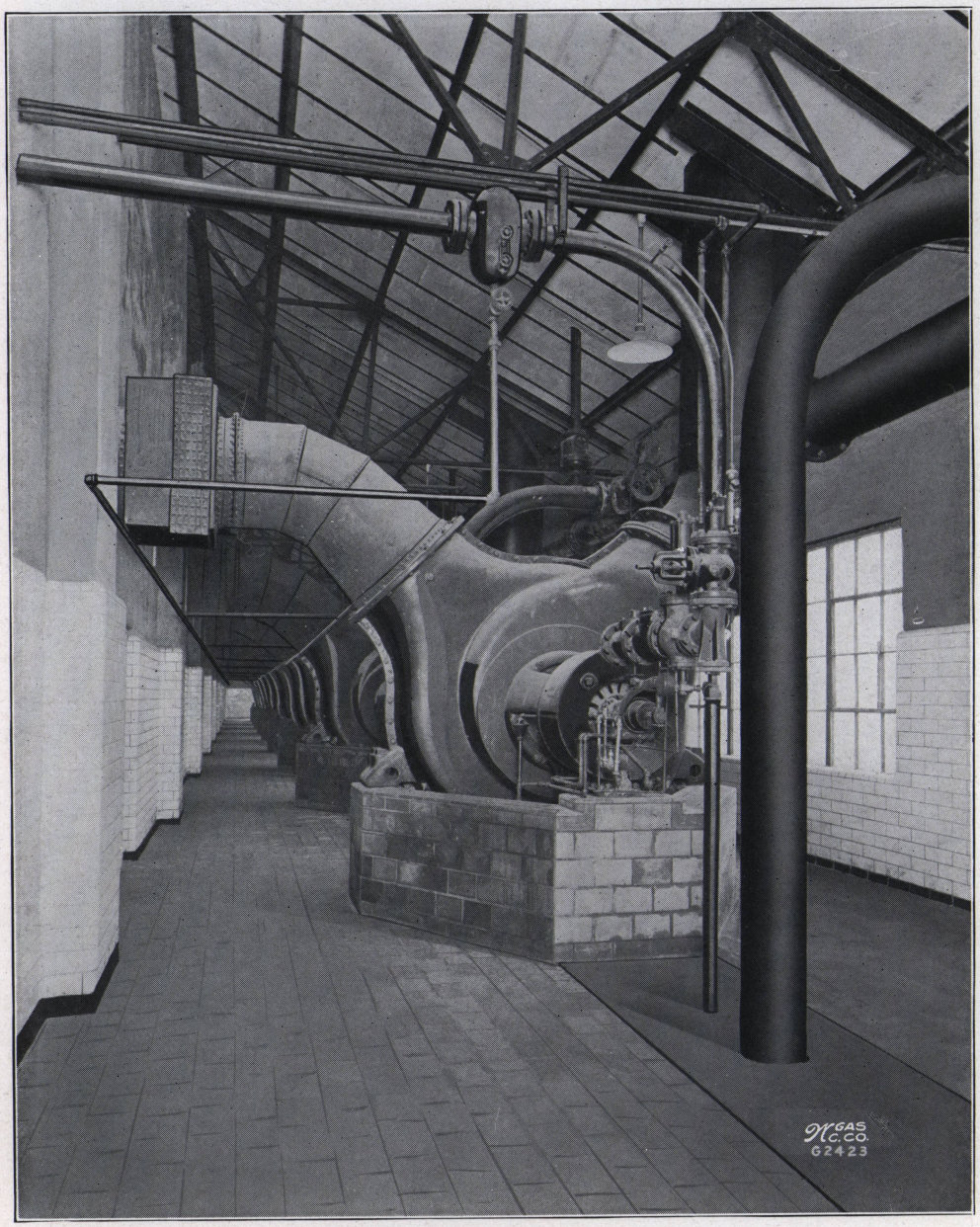
Nine 11'-0" Carburetted Water Gas Sets—Chicago, Ill.



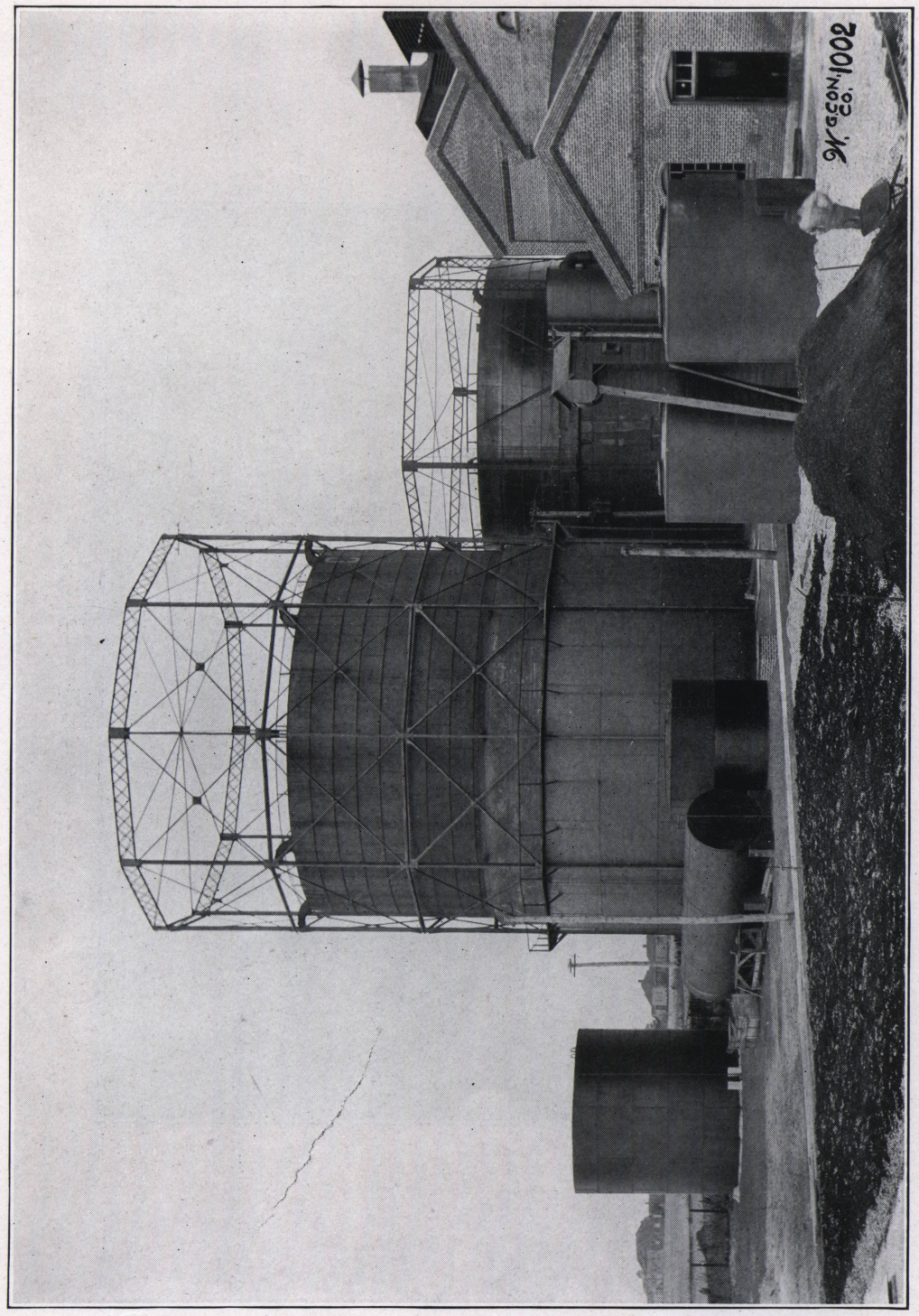
Operating Floor—Chicago, Ill.



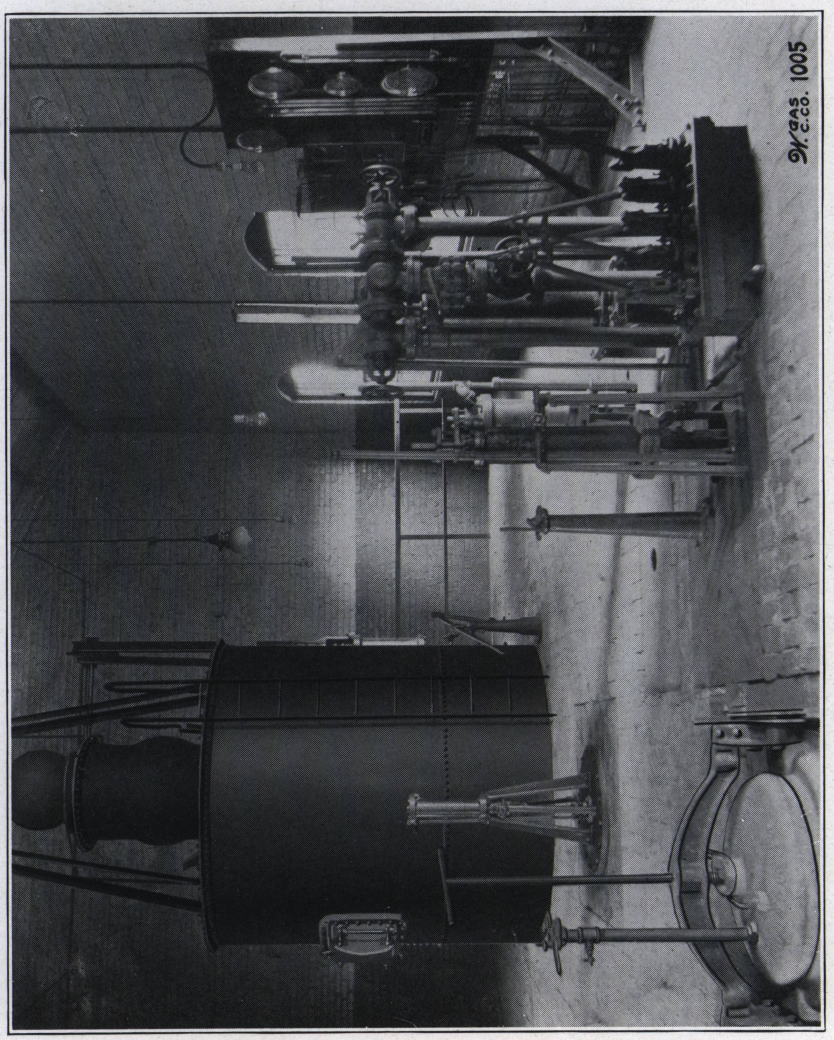
Coke Charging Equipment—Chicago, Ill.



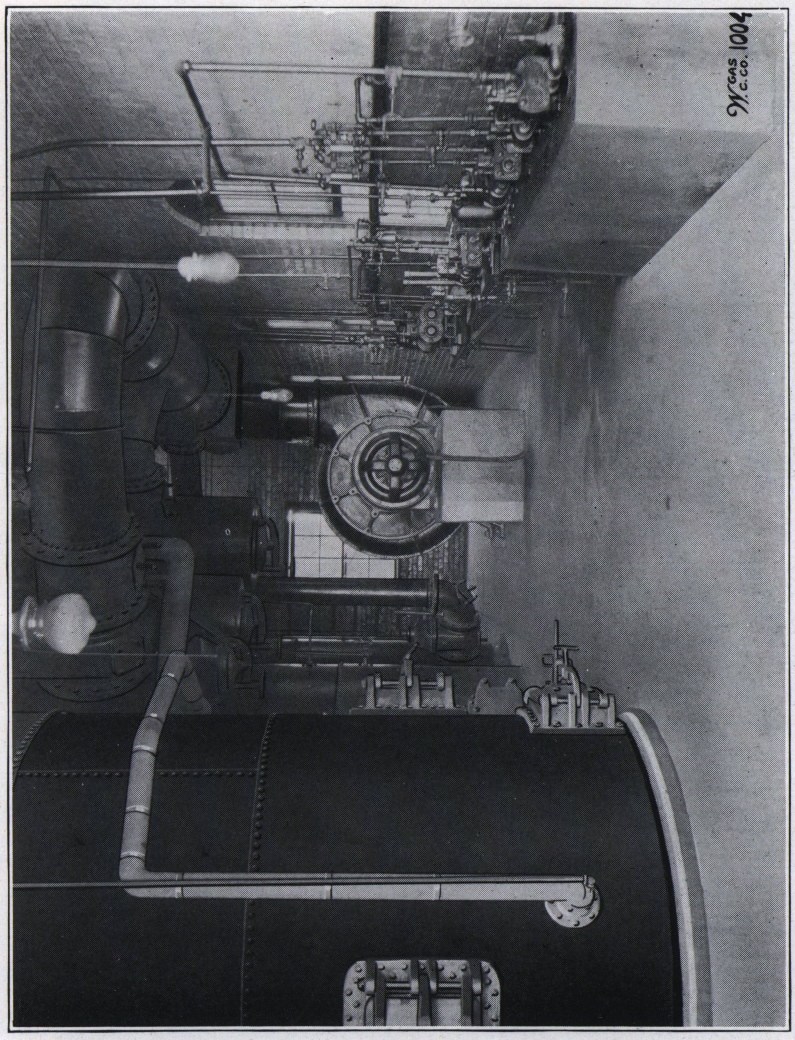
Blower Room—Chicago, Ill.



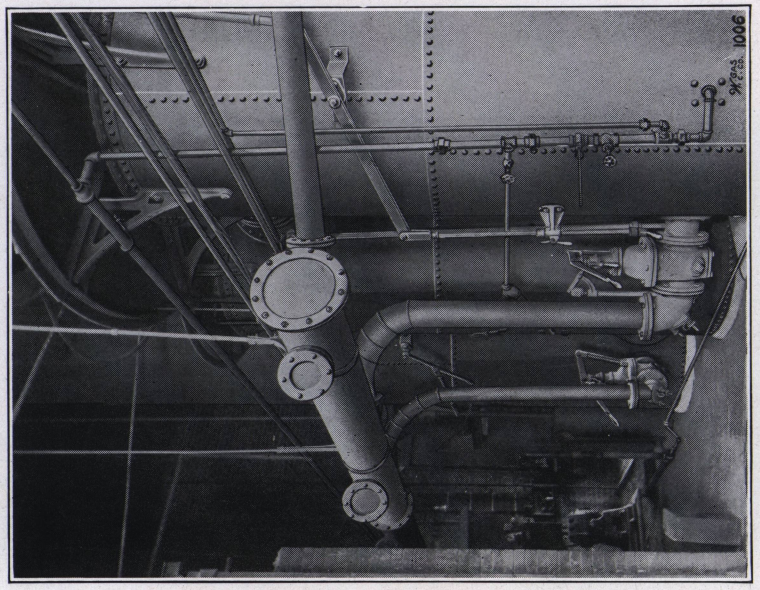
A Complete Gas Plant Built at Rocky Mount, N. C.



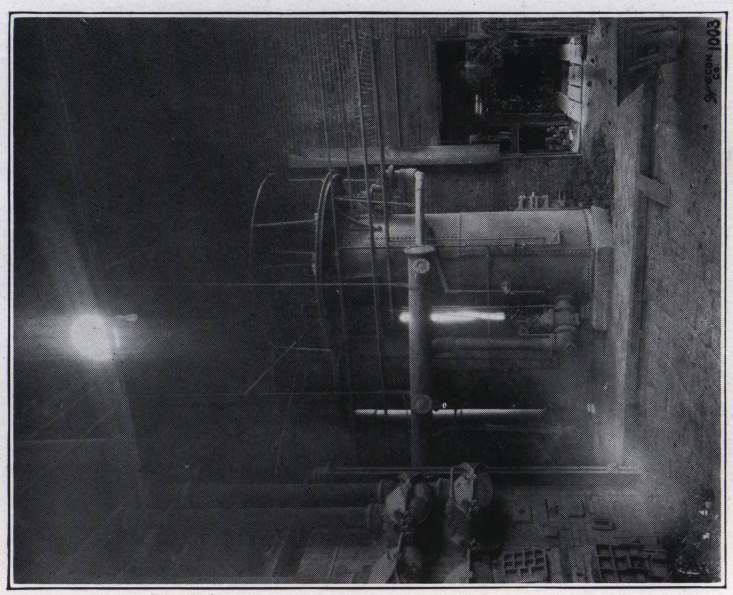
Operating Floor of an 8'-6" Set



Ground Floor of an 8'-6" Set



4'-0" Standard Set at Rapid City, S. D.



4'-0" Set as an Auxiliary to Benches

A Carburetted Water Gas Set consists in general of the following parts:

GENERATOR Where the blue gas is formed by passing steam through the incandescent bed of fuel.

CARBURETTER Where the blue gas from the generator mixes with a fine spray of oil which is introduced into the top of the shell by the "Improved Center Oil Spray" forming an oil gas which is fixed by passing over the hot checker brick in the Carburetter and Superheater.

SUPERHEATER Containing checker brick which are raised to a high temperature during the blasting period which heat is utilized in fixing the oil gas produced in the carburetter.

SEAL TAR BATTER Which acts both as a valve to prevent the gas returning back from the relief holder during the blasting period, when it would escape at the stack valve and also as a scrubber to remove much of the heavy tar in the gas before it goes to the relief holder.

BLOWER For Producing the necessary blast to raise the temperature of the machine.

REVERSING VALVE By means of which the capacity of the machine is increased and an increased economy in fuel consumption obtained owing to the reversal of the direction of the flow of steam in the generator.

GENERATOR BLAST VALVE For regulating the supply of air to the generator.

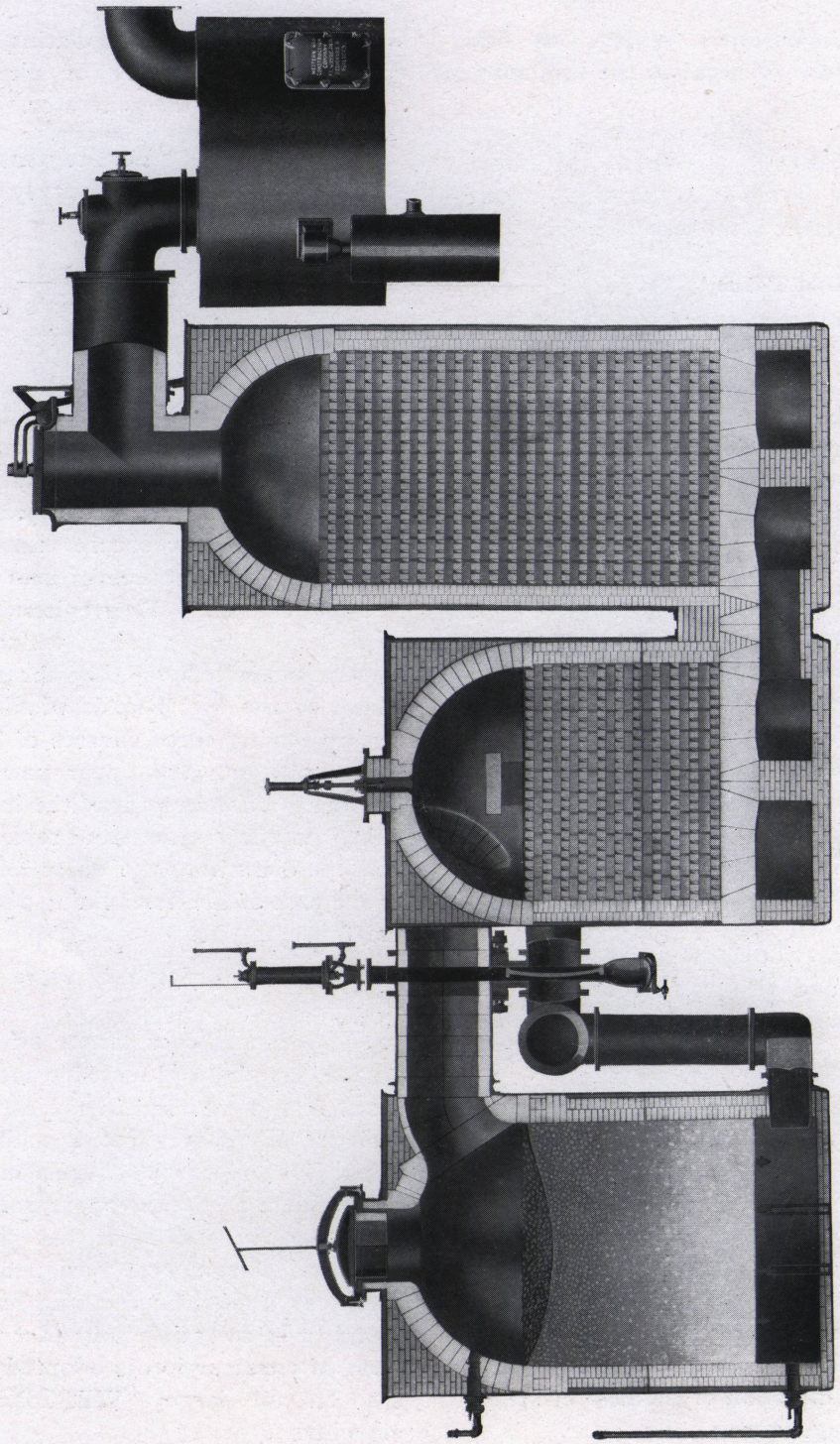
CARBURETTER BLAST VALVE For regulating the supply of air to the carburetter.

GENERATOR

GENERATOR This consists of a heavy steel shell lined with fire brick.

FIRE BRICK LINING The Fire Brick Lining is of double thickness, the inside and outside courses being laid to break joints. Between the outer course and the shell is placed a course of heat insulating material. Convenience in renewing the inner lining, which is mostly subjected to the abrasive action of the fuel bed, is provided for, by having three courses of key brick built into the upper part of the lining whereby part of the inner lining may be removed and replaced without disturbing the outer lining or the part of the inner lining above the fire.

ARCHED DOMES In order to increase the capacity of water gas machines larger offtake nozzles have been provided in recent years than were used in the earlier designs of water gas machines. These larger nozzles furnished a tile problem that could not be solved by using the old style flat tiles. Spherical domes were designed to overcome this difficulty and were found to be so satisfactory that this form of construction is adopted for use on all large "WESTERN" machines.



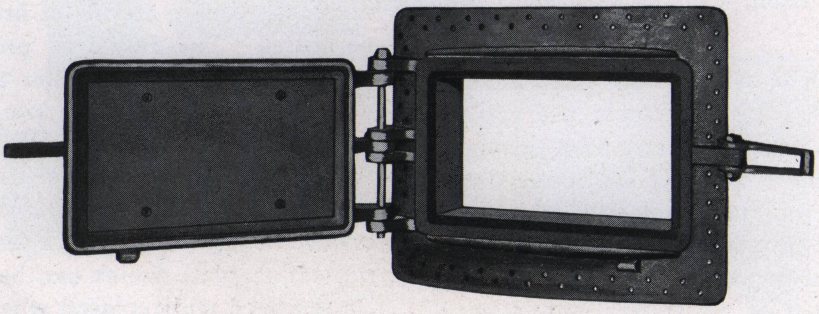
Sectional View of Standard "WESTERN" Water Gas Machine

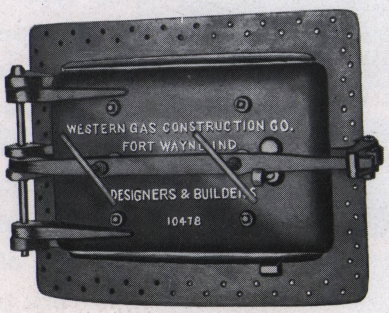
In this construction every dome tile is locked in firmly like the stones of an arch, each tile fits closely on all surfaces and all large circular openings come as true circles intersecting the spherical dome and their tiles locked in as positively as the dome itself.

CLINKERING DOORS — The Clinkering Doors are typical of the general construction throughout the "WESTERN" machines, being of rugged construction and ample proportions to withstand the excessive wear and tear to which this part of the apparatus is always subjected. They are large in size, allowing easy access to all parts of the grate, and are provided with heavy cast iron liners which act as a protection to the door frame while clinkering, these liners being easily and cheaply replaced. The doors are self-sealing, being provided with substantial asbestos gaskets and are kept tightly closed by means of heavy cast steel cross bars. Liner blocks are provided for each door to facilitate the replacing of the brick which form a protection for the doors from the excessive heat of the fire.

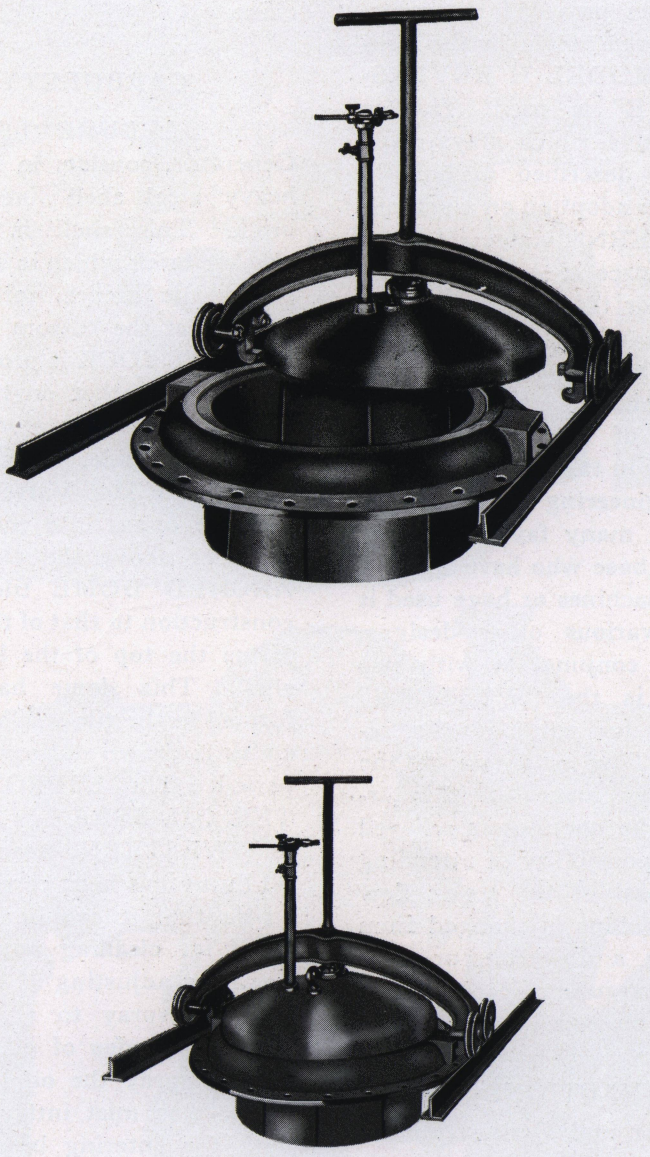
GRATE BARS — Are on a level with the bottom of the clinkering doors, allowing the full height of door to be utilized for clinkering purposes. They are made of good quality steel to withstand the high temperatures and are properly supported by means of heavy cast iron bearing bars, the grate bars being properly spaced to allow ample passageway for the air during blasting periods.

CHARGING DOOR — Is carefully designed to prevent cracking under the severe strains of fire temperatures. The frame is provided with a heavy cast iron liner to prevent injury to the dome tile when barring down the generator from the top to break up the clinkers. The cover is protected from the excessive heats by means of a cast iron protection plate which can be readily removed and replaced when it is burned through. A heavy cast steel crossbar is used to fasten the cover tightly to the frame. The crossbar and cover are mounted on track wheels so that they can easily be moved entirely out of the way when charging the fuel into the generator. This type of door with the cover mounted on track wheels has the important feature of an even wearing surface where the door and frame come together thus eliminating the possibility of any escape of gas at this place. Mounted on the cover of the charging door is a sight cock to enable the operator to observe the conditions of the fuel bed. The smaller sizes of machines which are provided with platforms and operated from the ground floor have the cover and crossbar arranged to swing around on a guide in the usual way, to allow clear space for charging purposes.





"WESTERN" CLINKER DOORS



"WESTERN" Rolling Type of Charging Door

GENERATOR—CARBURETTER CONNECTION

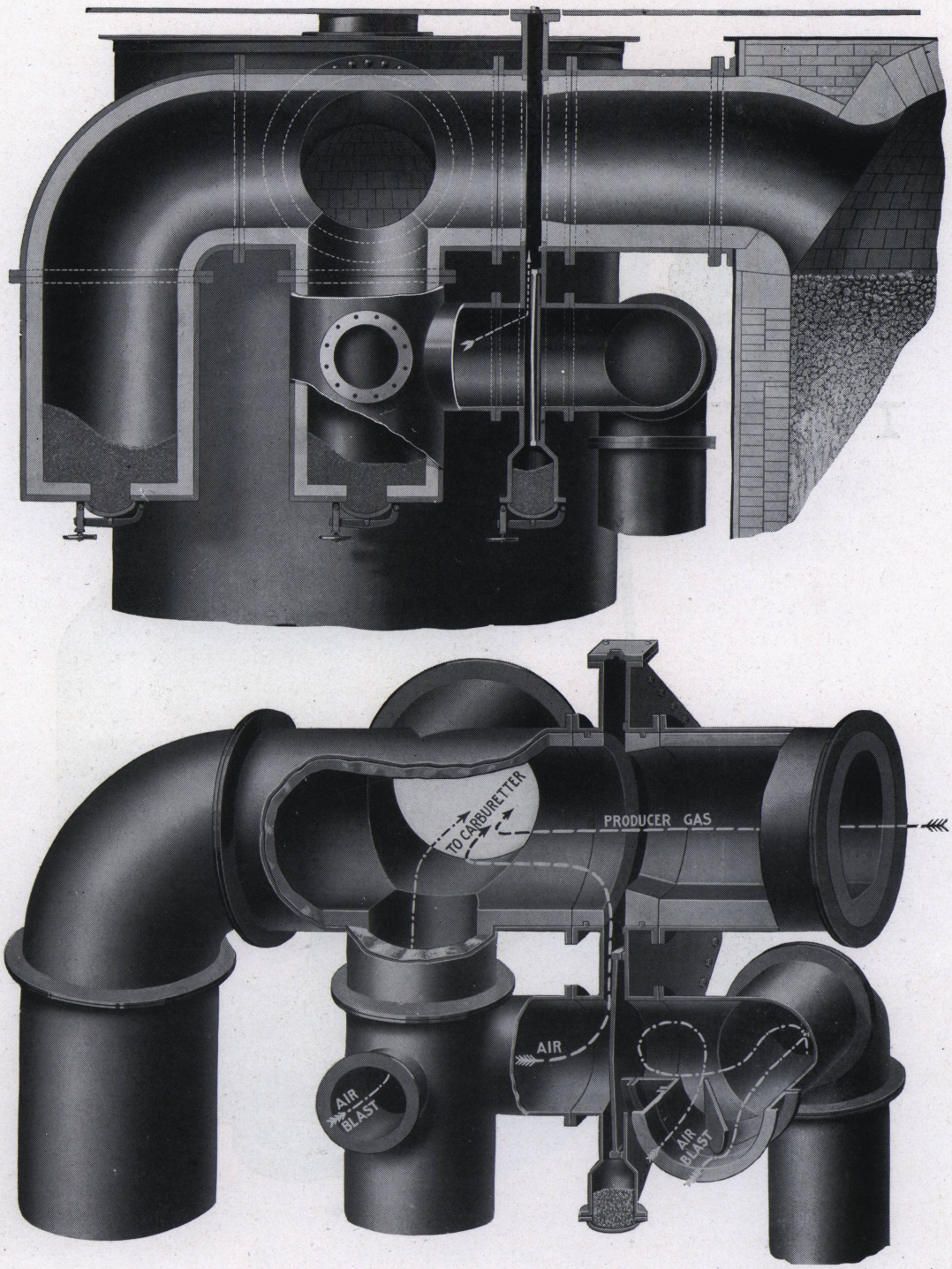
In machines provided for reversing the flow of steam in the generator our "MODEL H REVERSING VALVE" is used. This is the "Hot Valve which stays cool" and is fully described in bulletin 210-D. By its adoption on all standard "WESTERN" water gas sets more clear space is secured on the operating floor than in other types of machines, which greatly facilitates the whole operation of the machine. This, our new Hot Valve, marks one of the most recent achievements in the advancement of the gas engineering industry and has received many favorable comments from those who have adopted it on their machines or have used it to replace various other designs. Working in conjunction with this Hot Valve is the "WESTERN" arrangement for automatically reversing the flow of steam in the generator. By means of this arrangement, the operator is relieved from the responsibility of attending to the reversal of the steam flow when the machine is changed from an uprun to a downrun, or vice-versa, with resultant economy in fuel besides increased capacity.

The CONNECTIONS between the Generator and Carburetter are so arranged that two large dust pockets are provided in which any breeze or dust that passes over from the Generator is collected, thus relieving the checker brick in the carburetter of considerable dirt and sediment and lengthening the periods between re-checkering the machine.

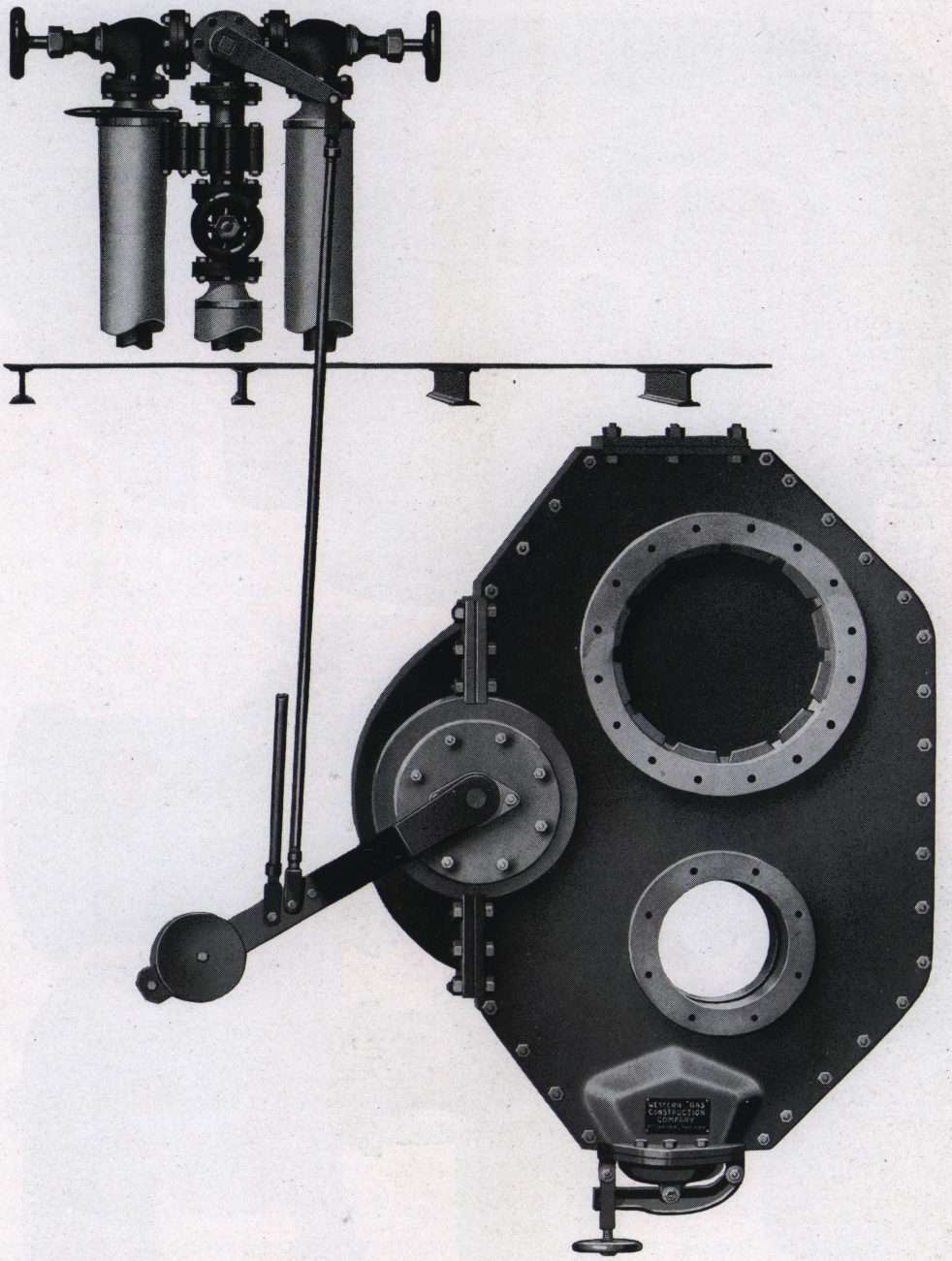
CARBURETTER

The CARBURETTER, like the Generator, consists in general of a heavy steel shell lined with fire brick. This shell is filled with checker brick which is supported on strong tile arches, forming a gas passage at the bottom of the shell. A SIGHT COCK is provided on the shell and another on the top head to enable the operator to observe the heats inside. The nozzle connecting the Hot Valve to the Carburetter opens into the vaporizing chamber above the checker brick. ARCHED DOME tile similar in construction to that of the Generator forms the top of the lining in the shell. This dome has a pocket formed in the tile into which the oil spray is drawn during the blasting period. The IMPROVED CENTER OIL SPRAY is furnished on all "WESTERN" machines. This oil Spray has been carefully designed so that it can be easily taken apart for cleaning purposes or renewal or adjusting of the cones inside the spray to adapt them to different grades of oil. By means of this spray the oil is broken up into a fine mist intimately mixing with the entering blue water gas.

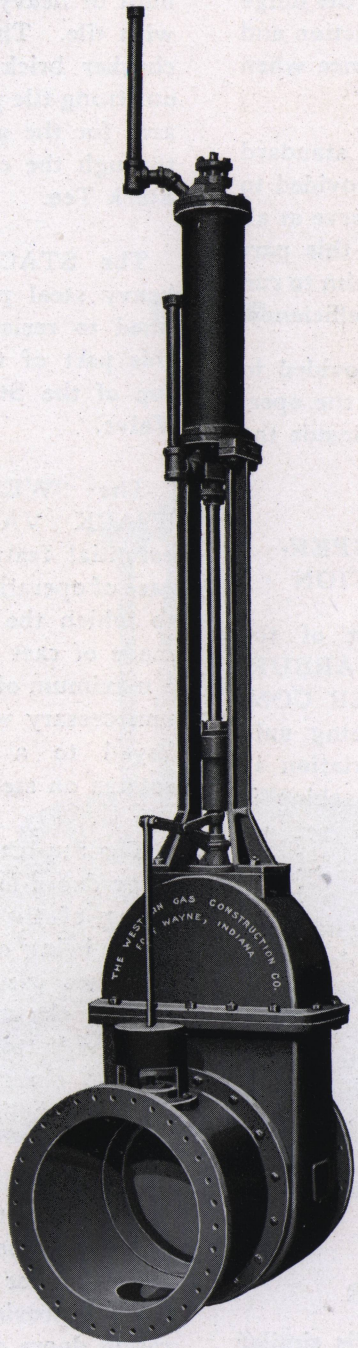
Large CHECKER BRICK DOORS are placed in the side of the carburetter to faciliate the removal and refilling of the checker



"WESTERN" Angle Connections



"WESTERN" Arrangement for Reversing Steam in Generator



"WESTERN" Blast Valve

brick. These doors are of the hinge bolt type strong in construction and presenting a neat appearance when mounted on the shell.

Connections for our standard thermo couples are also provided to enable the operator to observe at all times the temperature of this part of the apparatus enabling him to run the set at its maximum efficiency.

Sight cocks are also provided in the Carburetter to enable the operator to see the conditions inside the shell.

CARBURETTER—SUPERHEATER CONNECTION

A very important part of the water gas set is the CARBURETTER—SUPERHEATER CONNECTION due to its being subjected to a continual variation in temperature while the machine is in operation, tending to set up severe strains in this part of the machine, thereby causing a leaky connection. This difficulty has been entirely overcome in the design of the "WESTERN" connection by having it made of steel securely riveted to each of the shells, rectangular in design, and lined with heavy tile. In order to overcome any back pressure in the machine at this point, the gas passageways are made very large.

SUPERHEATER

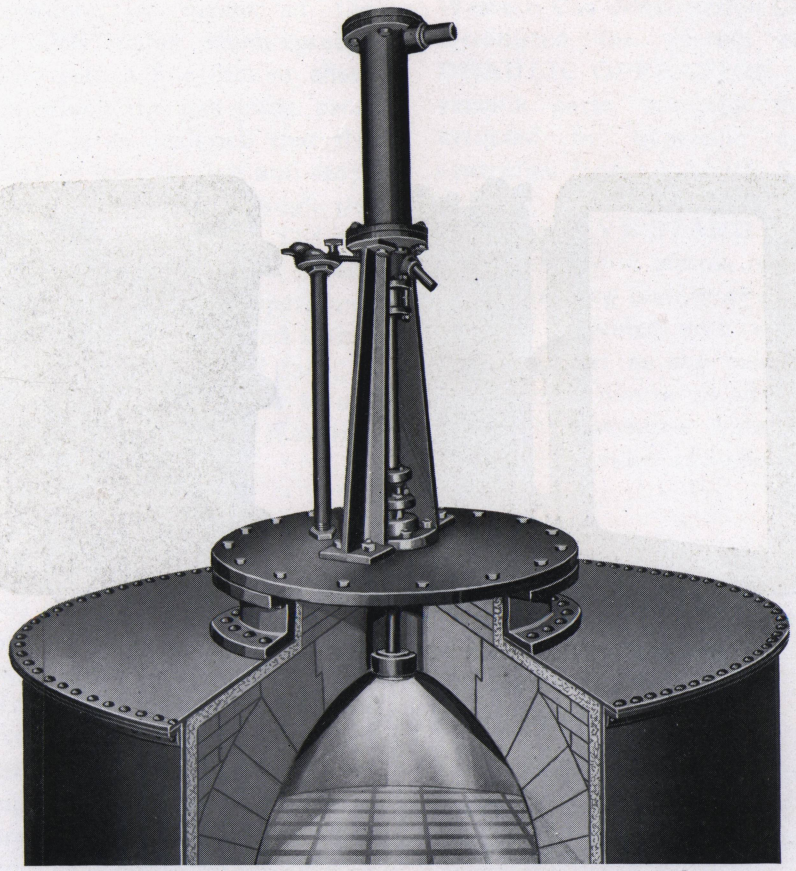
The SUPERHEATER is similar in general design and construction to the Generator and Carburetter, being built of heavy steel plate and lined with tile. This shell is filled with checker brick, which is supported on strong tile piers providing a large area for the gas to pass up to and through the checker brick into the Stack Tee.

The STACK TEE is built of heavy steel plate and is also tile-lined to resist the intense heat at this part of the machine. On the top of the Steel Tee is the Stack Valve.

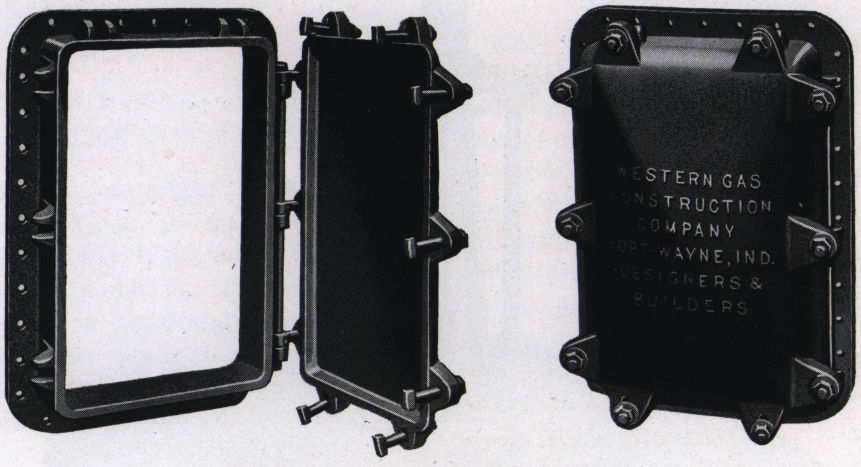
The "WESTERN" design of STACK VALVE combines the essential features of strength and ease of operation. The Bale or Arm to which the Cover is attached is made of cast iron designed to give a maximum of strength without any unnecessary weight, this arm being keyed to a strong shaft which rotates on steel roller bearings.

The Superheater is provided with large doors for the removal and refilling of the checker brick, these doors being of the same design as the ones used on the Carburetter. Sight cocks are also placed near the top and bottom to enable the operator to observe the conditions inside the shell.

The outlet of the Stack Tee is connected to the Seal Tar Batter by means of heavy cast iron pipe. Provision for cleaning this connection is provided for by means of round doors of large diameter, permitting free access to all parts of the pipe.



"WESTERN" Improved Center Oil Spray



"WESTERN" Checker Brick Doors

SEAL TAR BATTER

This part of the machine is an improvement on the earlier types of apparatus inasmuch as a large portion of the tar in the gas is removed at this point instead of being carried through to the scrubbers. The circulating water in the Tar Batter is introduced by means of the "WESTERN" spray which spreads the water into a fine film or sheet through which the gas must pass. The spray is so designed that the possibility of its plugging and stoping the flow of water through the seal is entirely eliminated. The importance of this feature is easily realized by all water gas operators. Numerous baffles are placed inside the shell and the action of the gas passing between these tends to deposit most of the tar which it carries in suspension.

The tar collecting in the bottom of the Seal Tar Batter can be easily removed by means of a large clean-out door which is provided for this purpose near the bottom of the shell. The level of the water in the Seal Tar Batter is kept constant and can be adjusted to the proper level for securing a minimum amount of back pressure on the machine with sufficient seal to prevent the gas returning from the relief holder and escaping through the stack valve during the blasting period, this adjustment being made by means of the "WESTERN" ADJUSTABLE OVERFLOW placed on the side of the shell.

HYDRAULIC CONTROL

The trend in the design of Water Gas Sets is to provide large connections to increase the capacity, thus necessitating larger valves and moving parts which makes operation by hand too slow and cumbersome.

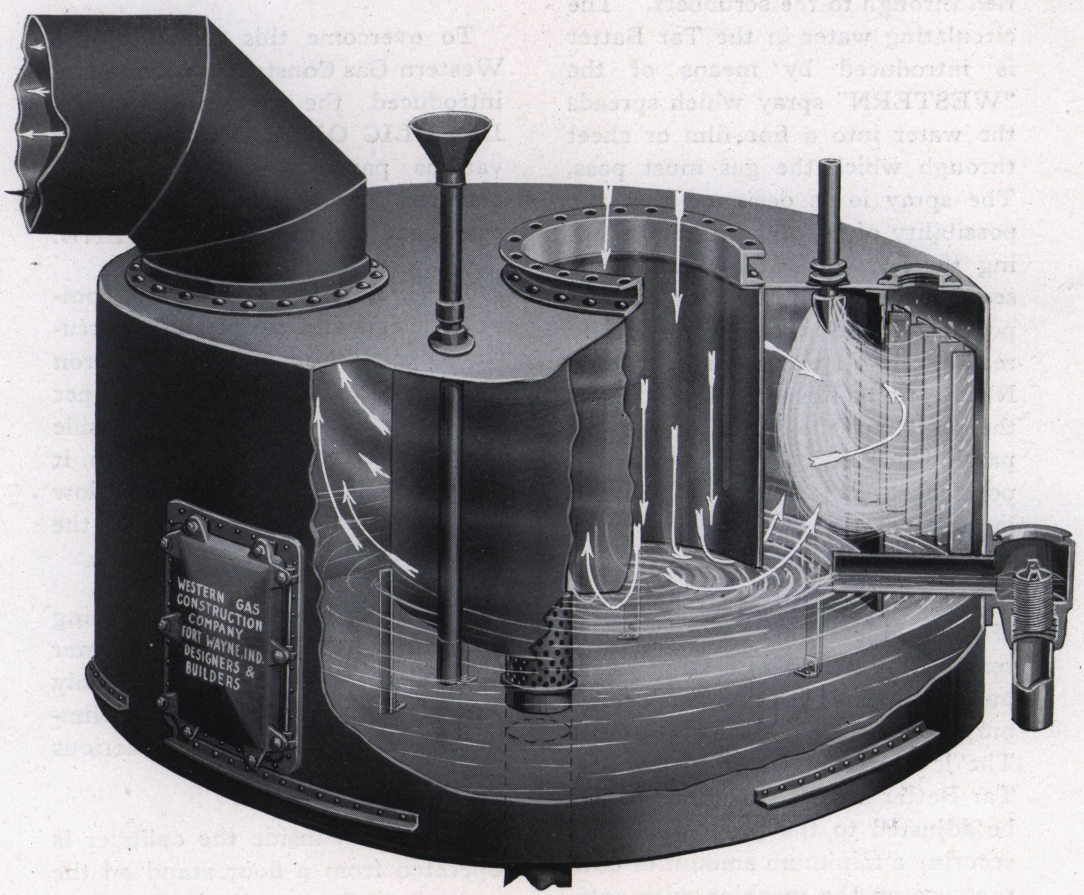
To overcome this difficulty, the Western Gas Construction Company introduced the system of HYDRAULIC OPERATION of these various parts, whereby they are actuated by hydraulic cylinders controlled from a VALVE STAND.

This VALVE STAND is of compact design and simple in construtution consisting mainly of a cast iron cylinder provided with the proper ports so that as the piston inside the cylinder moves up and down, it allows the pressure water to flow to the hydraulic cylinders on the apparatus.

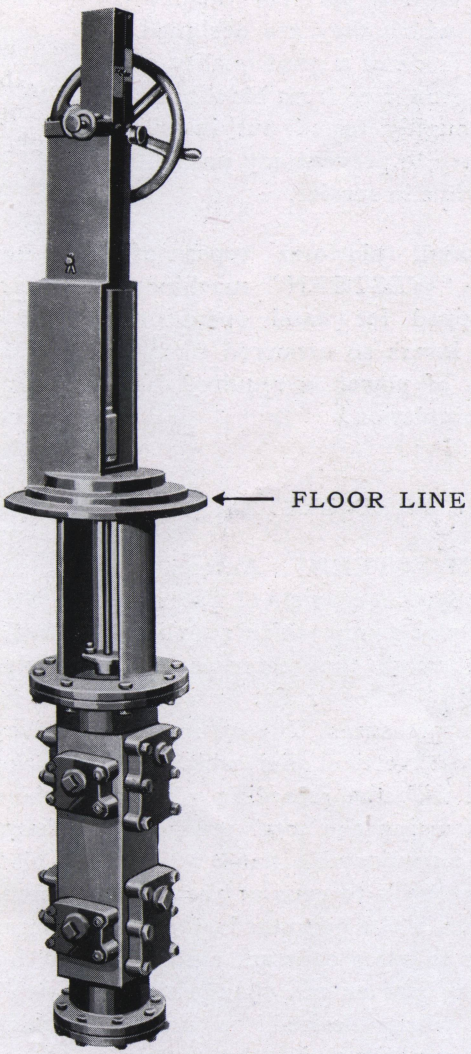
The ports on the cylinder being so arranged that the pressure water acts on the various cylinders only in their proper sequence, thus eliminating any possibility of serious mistakes arising.

The piston inside the cylinder is operated from a floor stand on the operating floor and is carefully counterbalanced to insure ease in operation.

Attached to the top of the floor stand is an indicator which shows the position of the machine in the cycle of operation and is of considerable aid to the operator in the economical running of the set.



"WESTERN" SEAL TAR BATTER



"WESTERN" HYDRAULIC CONTROL VALVE STAND

HYDRAULIC CYLINDERS

The hydraulic cylinders are properly proportioned to operate with ease the various parts of the machine for which they are designed. They are made of a good quality of grey cast iron, free from blow holes and thoroughly tested out in our own factory to prevent any possible leakage while in service.

The small platform types of standard "WESTERN" machines are equipped for hand operation with the levers so arranged that a minimum of power is required for their manipulation.

OIL FEED SYSTEM

The "WESTERN" Automatic Oil Feed System consists of a steam driven duplex pump which supplies the oil through the meter to the "WESTERN" Center Oil Spray at a uniform pressure. The oil meter has a large vertical dial which is furnished with the recording wheel system showing the total readings and also an adjustable hand which can be set back to zero at the end of each run. The operator is, therefore, able to use a constant amount of oil each run or can change this amount when desired to meet varying conditions in the water gas set. By passing through the "WESTERN" Center Oil Spray the oil is introduced into the Carburetter in the form of a fine mist which enables it to become completely mixed with the water gas, thus eliminating all waste of this expensive component of the gas in the gasification.

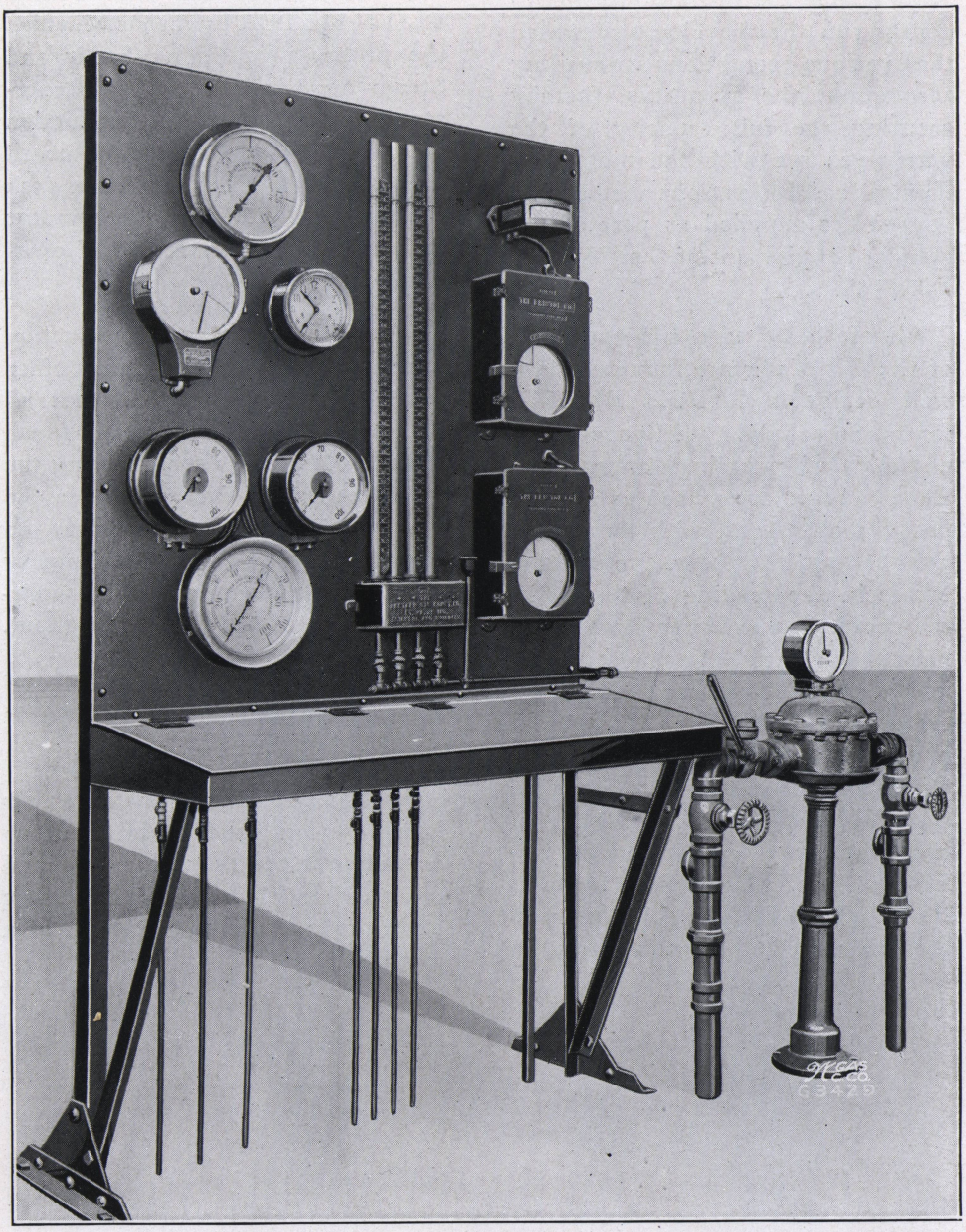
BLOWING EQUIPMENT

The Standard "WESTERN" Carburetted Water Gas Sets are equipped with a well designed BLOWER capable of producing at normal rating the large volume of air at high pressure so essential to the economical operation of the modern water gas machines. As a protection against injury to the blower should an explosion occur in the blast pipe, a check valve is installed in the trunk connecting the blower to the water gas set.

CHARGING APPARATUS

For the small platform type of "WESTERN" machines the usual equipment furnished for charging the fuel into the generator is a steam driven hoist which raises the coke bucket from the ground floor to where it can be swung over the charging door of the generator. This hoist is quick acting and smooth in its operation. For the larger sizes of machines equipped with operating floors, coke buggies with bottom discharge are furnished which are easily handled and of strong construction, well able to withstand the severe service which they necessarily have to undergo.

A platform elevator is generally installed to bring these buggies from the ground floor up to the operating floor.



"WESTERN GAUGE BOARD

METERS AND GAUGES

To enable the operator to intelligently run the machine and watch the various conditions prevailing throughout the apparatus, thereby securing the full capacity of the water gas set with the most economical results, various meters and gauges are supplied as part of the standard equipment of the "WESTERN" Sets.

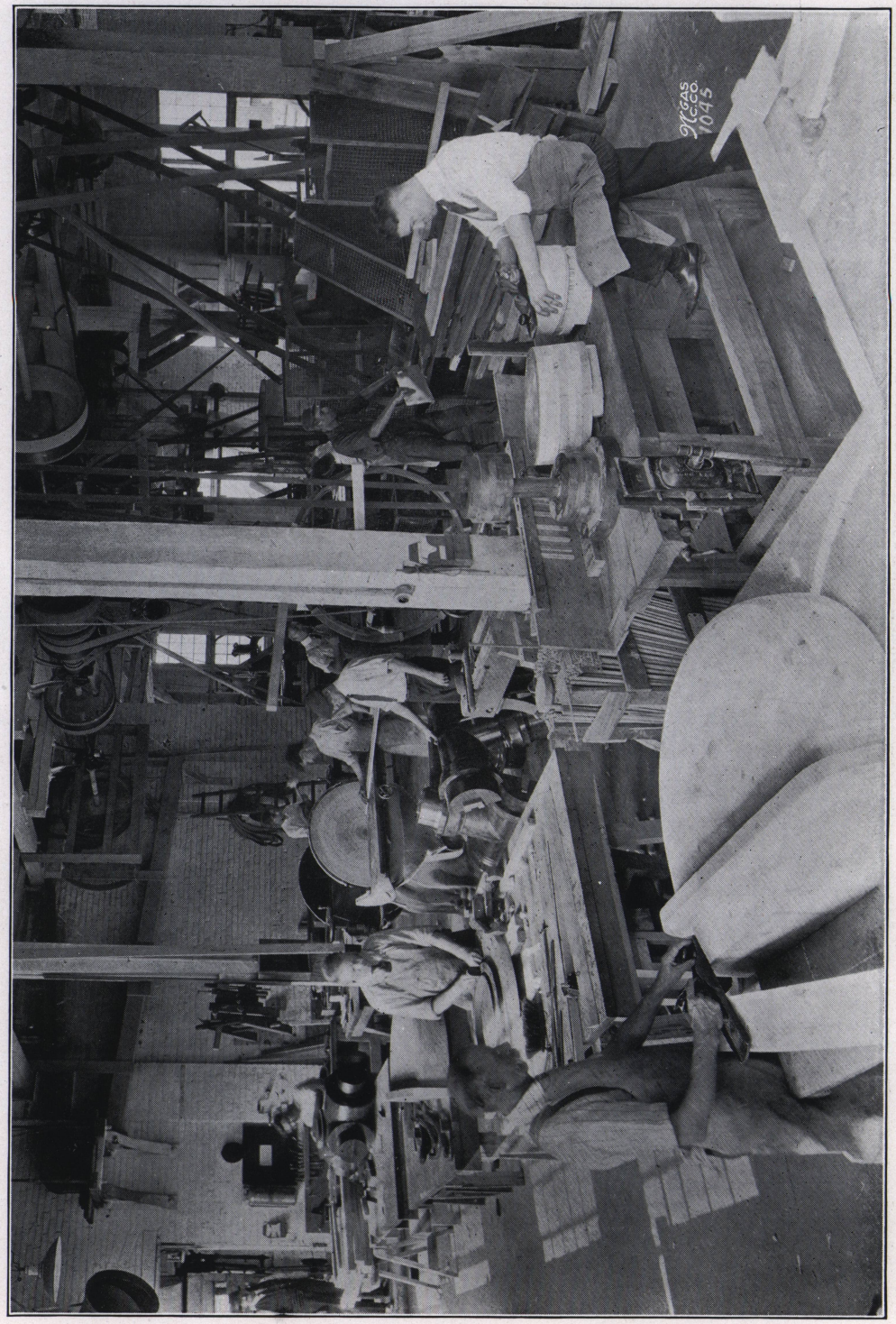
All of these, with the exception of the Oil Meter are mounted on a well designed GAUGE BOARD, made of steel plate, well proportioned and of pleasing appearance. These gauges are placed as near as possible on a level with the eye of the operator in order to prevent any errors in the reading of them. In the center is placed the four gauge glasses showing the pressure in inches of water column of the Generator and Carburetter blast, inlet and outlet of the Seal Tar Batter. On either side of these are arranged the TIME CLOCK, which is of excellent make and thoroughly reliable, OIL PRESSURE GAUGE, PYROMETER, to enable the operator to watch the temperature in the Carburetter and Superheater, AIR FLOW METER and STEAM FLOW METER by means of which the proper proportion of Air and Steam are admitted to the Generator for the economical production of the gas. The front of the board is arranged so that it forms a desk for the convenience of the operator in keeping his daily record of operation.

The Western Gas Construction Company have their main office located at the factory so that all departments are in constant touch with one another thus enabling the work contracted for, to receive the special attention so necessary to insure that only the highest quality of materials are used and the workmanship is of the best throughout.

The following illustrations of our plant show the facilities at our disposal.

A large quantity of raw materials is always on hand enabling us to execute our contracts promptly and make quick delivery of all apparatus entering into the construction of a gas plant.

DRAWING ROOM

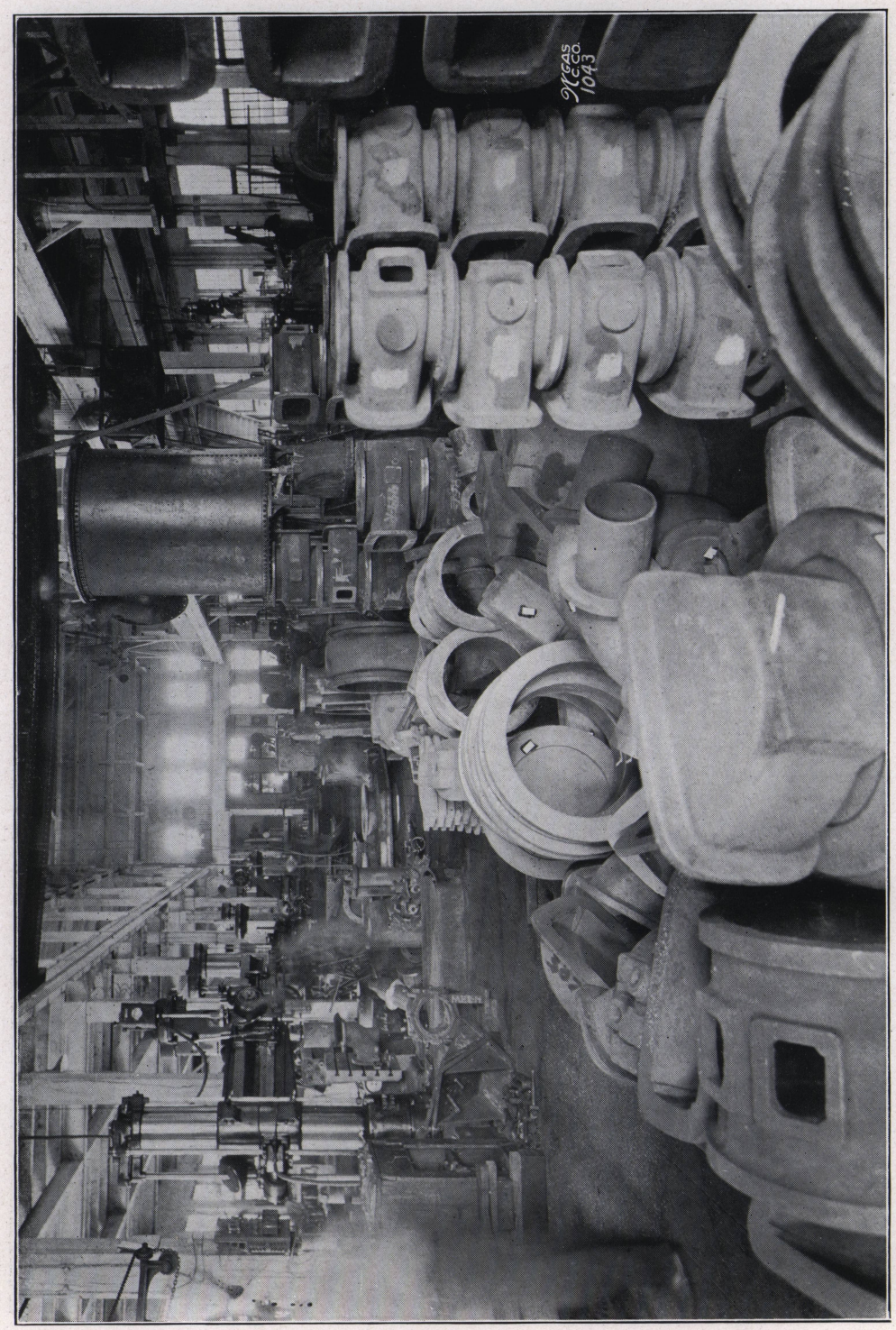


PATTERN SHOP

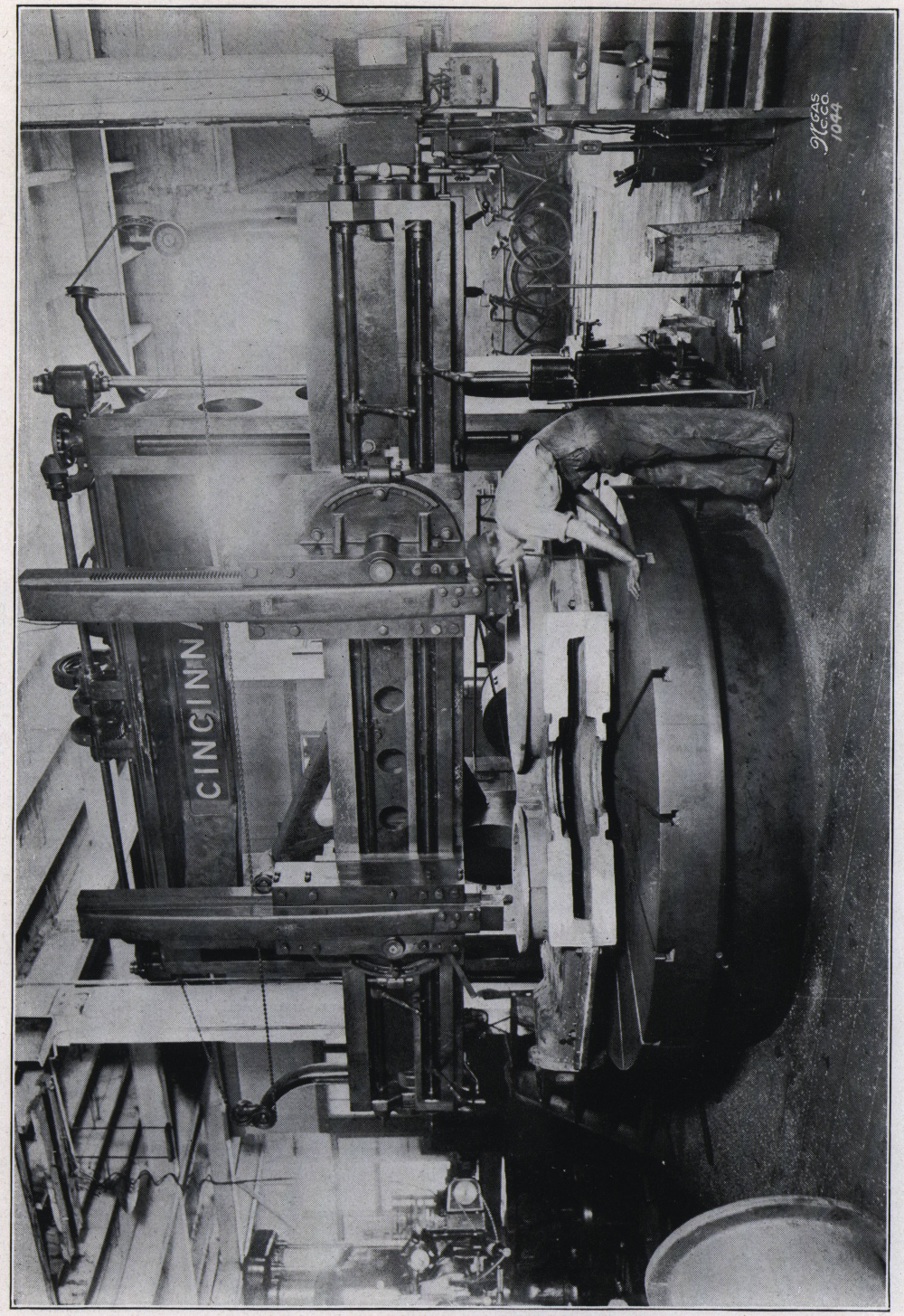
FOUNDRY

FOUNDRY

SAND BLASTING IN CLEANING ROOM



MACHINE SHOP



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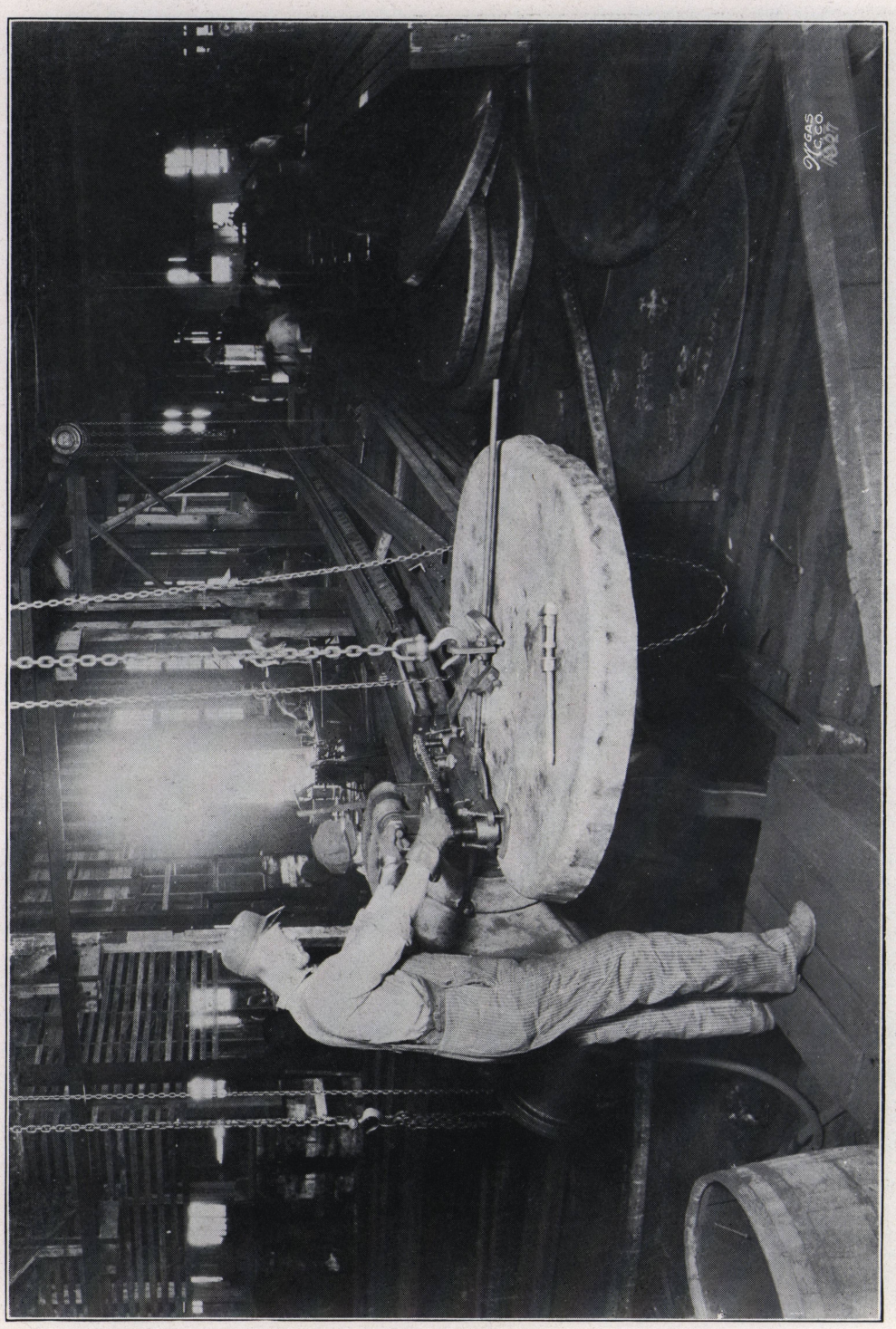
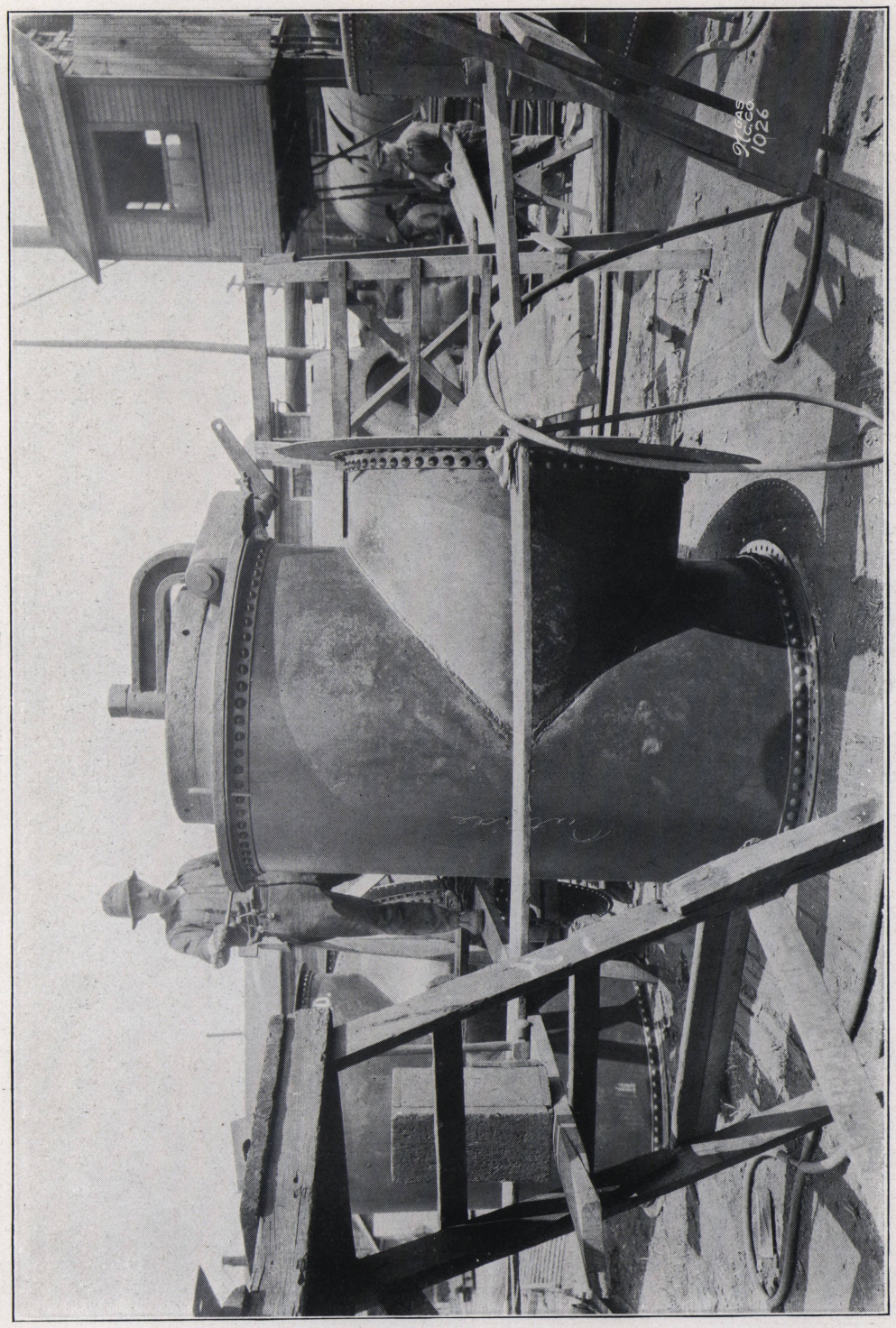
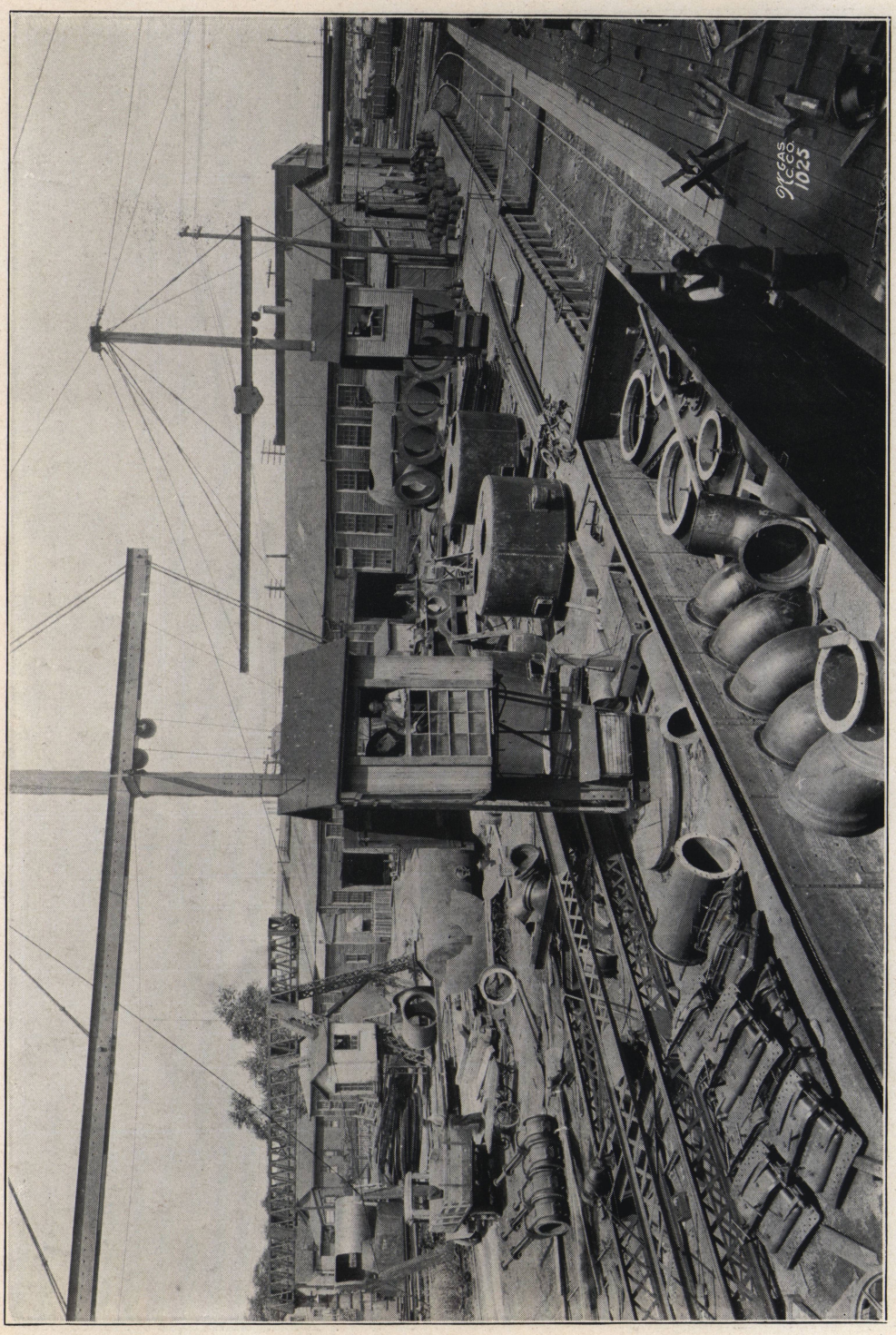


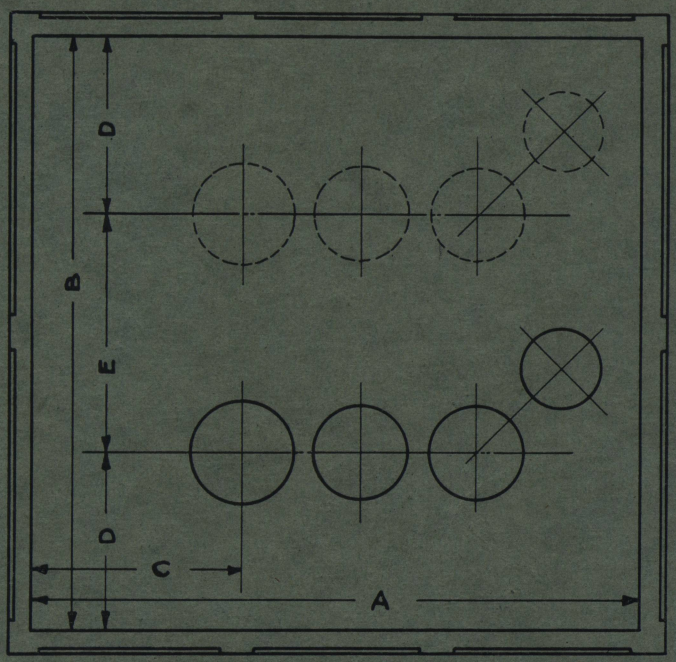
BOILER SHOP



ERECTING YARD



SHIPPING YARD



SIZE SET	A	B	C	D	E	HEIGHT UNDER ROOF TRUSS
4'-0"	24'-6"	24'-6"	8'-6"	7'-2"	10'-2"	22'-0"
4'-6"	25'-6"	25'-6"	9'-0"	7'-6"	10'-6"	22'-0"
5'-0"	27'-6"	26'-9"	9'-6"	7'-10"	11'-1"	23'-0"
5'-6"	30'-0"	29'-2"	10'-0"	8'-3"	12'-8"	24'-0"
6'-6"	39'-0"	34'-6"	12'-0"	10'-6"	13'-6"	30'-0"
7'-6"	44'-0"	40'-6"	14'-0"	12'-6"	15'-6"	32'-0"
8'-6"	49'-0"	45'-6"	16'-0"	14'-0"	17'-6"	33'-0"
9'-6"	54'-6"	50'-6"	18'-0"	15'-6"	19'-6"	35'-0"
10'-6"	57'-0"	55'-6"	17'-0"	17'-0"	21'-6"	36'-0"
11'-0"	60'-0"	58'-6"	18'-0"	18'-0"	22'-6"	40'-0"

TABLE SHOWING APPROXIMATE SPACE REQUIRED FOR "WESTERN" WATER GAS SETS

THE GENERAL PRINTING CORP.
FORT WAYNE, IND.